Volume Title: Capital Formation in Residential Real Estate: Trends and Prospects

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Volume Publisher: Princeton University Press

Volume ISBN: 0-870-14099-X

Volume URL: http://www.nber.org/books/greb56-1

Publication Date: 1956

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Chapter URL: http://www.nber.org/chapters/c1323

Chapter pages in book: (p. 104 - 121)

CHAPTER VII

THE DECLINE IN REAL CAPITAL PER DWELLING UNIT

THE level of deflated expenditures for new private housekeeping dwelling units is determined both by the number of units constructed and by the average expenditure (in constant prices) for such units. In Chapters V and VI the long-term movements in the number of new dwelling units started and the forces which have shaped these movements were analyzed. In this chapter the long-run changes in real capital per dwelling unit are described and the major compositional and physical factors associated with these changes are identified. In the next chapter the more general demand factors underlying these changes are discussed.

Average Expenditure per New Dwelling Unit

The average construction expenditure (in current prices) per private nonfarm housekeeping dwelling unit started has more than quadrupled over the past sixty years, rising from a little more than $2,000 per unit in the nineties to about $8,000 in the late forties and more than $9,000 in the early fifties (Table J-1)[1] Real average expenditure per unit, however, has shown an opposite movement, reaching a level in recent years about two-fifths below that of the nineties. Deflated expenditure per dwelling unit was about $6,000 (in 1929 prices) during the first of the six decades under study and averaged about $3,800 during the period 1946-1953 (Table J-1).[2] The increase in expenditure per unit in current prices, of course, was the net result of this decline in real expenditure per unit and the rise of about 500 per cent in the level of construction costs over the past sixty-four years (see Table B-10).

When random fluctuations are disregarded, average expenditure per unit in current prices shows an accelerating increase from the nineties to the twenties, a major decline during the depression, some recovery before World War II, a fall during the war, and a marked rise in the postwar years (Chart 12). The increase from the 1890-1899 decade

[1] The estimates in Table J-1 are subject to some slight distortion since the average expenditure per unit was determined by dividing total expenditures (work put in place) in each year by the number of dwelling units *started* in the same year.

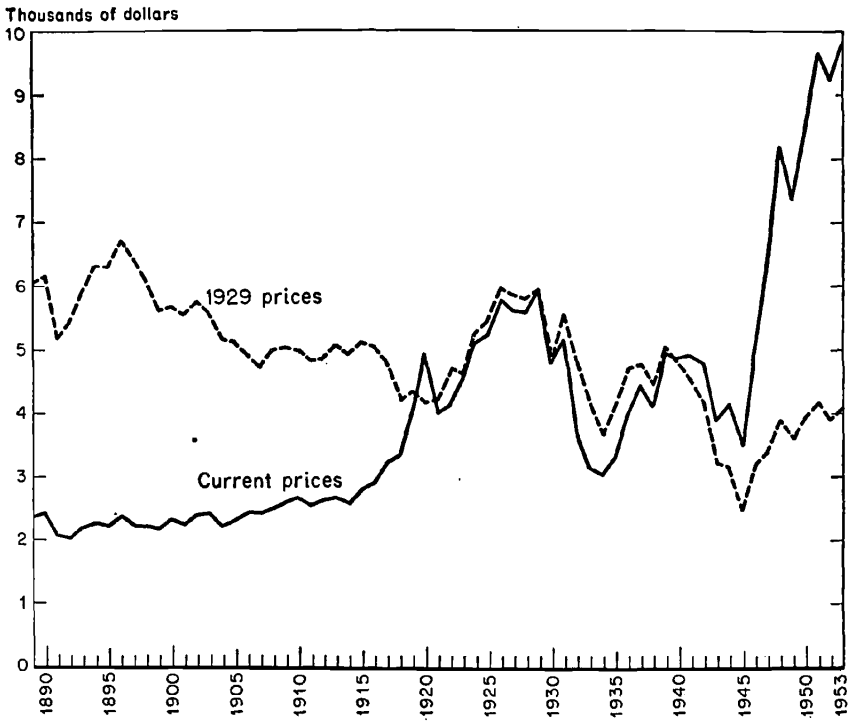
[2] The magnitude of the decline in real capital per dwelling unit may be slightly overstated because of a possible upward bias in the construction cost index used for adjusting expenditures to a constant price base. But it is most unlikely that the bias is large enough to alter any of the major conclusions derived from the adjusted series. For a discussion of the degree of bias inherent in the construction cost index, see Appendix C.

to the twenties was more than 130 per cent ($2,194 to $5,137); the increase from the twenties to the period 1946-1953 was more than 55 per cent ($5,137 to $8,029).

Average expenditure in constant prices is characterized by more short-term variation than average expenditure in current prices. When attention, however, is focused on major movements, it can be seen that expenditure per unit in constant prices experienced a continuing decline from the nineties through the 1910-1919 decade, rose sharply during the twenties, fell drastically during the depression, increased during the years before World War II, fell again during the war, and experienced some recovery during the postwar years (Chart 12). The

CHART 12

Average Construction Expenditure per Private Nonfarm Dwelling Unit Started, in Current and 1929 Prices, 1889-1953



Source: Table J-1.

decline from the nineties to the 1910-1919 decade was about 19 per cent ($6,017 to $4,891); the rise from the 1910-1919 decade to the late twenties was about 18 per cent ($4,891 to $5,789) and brought real expenditure per dwelling unit almost back to the level of the nineties;

the decline from the last half of the twenties to the period 1946-1953 was about 35 per cent ($5,789 to $3,768).

It appears that real expenditure per unit varied cyclically with the volume of residential building. For the period since 1900, troughs in residential building were associated with troughs in real expenditure per unit, and peaks in building with peaks in average expenditure. A portion of this variation is due to cyclical bias in the construction cost deflator; all construction cost indexes, including the one used in this study, tend to be more stable over the building cycle than actual construction costs or market prices of dwellings, because of the cyclical variability of builders' profits, variations in actual wage rates and materials prices from nominal wage rates and prices, changes in efficiency of site labor, etc. However, it is unlikely that the bias accounts for all or most of the apparent variation in real expenditure per unit. Rather, the cyclical variation suggests a shift in the composition of residential building toward more expensive units in the expansion phase of the long building cycle and toward less expensive units in the contraction phase.

Factors in the Decline of Real Capital per New Unit

The long-term decline in real input per new dwelling unit is so startling a phenomenon, and its continuance or discontinuance so important to the future course of residential capital formation, that it is essential to examine the forces behind this trend in some detail.

The factors associated with the recorded change in constant-price expenditure per new dwelling unit are many and their interrelationships are highly complex. Some of these factors, if operating in isolation, would have resulted in a rise in expenditure per unit; the others, apparently the more influential, in a decline in average expenditure. These forces can for convenience be classified into three general groups: shifts in the composition of new residential construction by location and type of structure, changes in the physical characteristics of the dwelling unit, and changes in important determinants of the demand for new dwelling units. In the following sections the most important elements of the compositional and physical forces are identified and where possible quantified.

Shifts in the Composition of New Construction

There have been several types of change over time in the composition of new residential construction: shifts in regional location of dwelling units, changes in the proportion of units built in urban and rural nonfarm areas, and changes in the proportion of units built in the several structure types.

As was indicated in Chapter VI, the northern states have accounted for a declining proportion of new dwelling units over the past six decades, while the shares of the South and West have increased (although there has been some variation in this pattern over time and within regions). In general, the average construction expenditure per new dwelling unit and the average value per existing unit have been higher in the northern states, particularly the New England, Middle Atlantic, and East North Central states, than in the southern and, until recent years, the western states (see illustrative data in Table 31).

TABLE 31

Regional Variation in Average Permit Value of New Dwelling Units and Average Value of Existing Units, Selected Periods, 1920-1951
(*dollars*)

	Average Permit Value, New One-Family Houses, 257 Cities, 1920-1936 (1)	*Median Value (Including Land), All-Owner Occupied Dwelling Units, 1940* (2)	*Average Permit Value, All New Urban Dwelling Units, 1946-1951* (3)	*Median Value (Including Land), All-Owner Occupied Dwelling Units, 1950* (4)
Northeast		3,979		8,300
New England	5,663		7,163	
Middle Atlantic	5,410		7,243	
North Central		2,945		7,300
East North Central	4,879		7,852	
West North Central	3,810		6,454	
South		1,989		6,100
South Atlantic	4,549		5,793	
East South Central	3,100		4,333	
West South Central	3,225		5,119	
West		2,926		8,500
Mountain	3,819		5,612	
Pacific	3,447		6,960	

Column — Source

1 David L. Wickens, *Residential Real Estate*, National Bureau of Economic Research, 1941, p. 298. The data were derived as the sample average of the individual year average permit values.

2 *Census of Housing 1940*, Bureau of the Census, Vol. III, Part 1, pp. 60, 86, 122, and 144.

3 *Construction and Housing, 1946-1947*, Bureau of Labor Statistics, Bulletin 941, p. 27; *Construction*, February issues for 1950 (p. 19), 1951 (p. 40), 1952 (p. 21), and 1953 (p. 18). The data were derived as the simple average of the individual year average permit values. The data include public housing.

4 *Census of Housing 1950*, Preliminary Reports, "Housing Characteristics, by Regions: April 1, 1950," Series HC-5, No. 3, p. 16. Data include values for vacant dwelling units for sale (excluding seasonal and dilapidated units).

In the South and West, climatic conditions often permit elimination of construction and equipment items usually necessary in the North, such as basements or central heating.[3] In addition, labor and material costs may have been less than in the North and new dwelling units historically may have been smaller or of lower quality. The declining relative importance in total nonfarm residential construction of the northern, and particularly the northeastern, states has tended to reduce the national average real expenditure per dwelling unit.

The remaining two changes in the composition of new construction are closely related, although their effects have been offsetting. From 1890 through the decade of the twenties, an ever-increasing proportion of all nonfarm dwelling units were built in urban areas (see Table 28). In the thirties and forties the trend was sharply reversed; the proportion of urban units in 1940-1950 was about as high as in the nineties. The changes in the types of residential structures, described in Chapter III, have closely paralleled this locational shift. The proportion of single-family houses built declined fairly steadily from 1890 through the twenties, with a corresponding increase in the combined proportion of two-family houses and multi-family structures. Since the early thirties, there has been a significant and consistent rise in the relative importance of new single-family houses and a corresponding decline in that of two-family houses and multi-family structures.

The changes in rural nonfarm–urban location and in structure type from the turn of the century through the decade of the twenties are, of course, associated with the rapid urbanization of the nonfarm population. The reverse trends since 1930 are in large part associated with the movement toward the suburbs.

In general, the average construction expenditure for rural nonfarm dwelling units has been lower than that for urban units,[4] probably as

[3] Only 38 per cent of the single-family detached houses built in the northeastern region of the United States and only 31 per cent of such houses built in the North Central region in the first half of 1950 did not contain a basement. Ninety-six per cent of such houses built in the South, 99 per cent in the Southwest, and 83 per cent in the West did not contain basements. Similarly, while practically all single-family detached houses built in the North and North Central regions during the same period had heating systems, 22 per cent of those built in the South and 14 per cent of those built in the Southwest lacked such facilities. *The Materials Use Study*, Housing and Home Finance Agency, 1952, pp. 5 and 30.

[4] Wickens inferred a one-third lower average expenditure for rural nonfarm dwelling units in the twenties, based on scattered data from the 1931 President's Conference on Housing (see David L. Wickens, *Residential Real Estate*, National Bureau of Economic Research, 1941, pp. 52-53 and 70-73). Similarly, the new estimates of dwelling unit starts and expenditures for such units for the pre-1921 period were derived on the basis of a level of expenditure per rural nonfarm dwelling unit one-third lower than that for urban units (see David M. Blank, *The Volume of Residential Construction, 1889-1950*, National Bureau of Economic Research, Technical Paper 9, 1954, sec. V).

a result both of lower material and labor costs and of smaller size or lower quality. This observation is supported by data on values for the inventory of owner-occupied dwelling units and structures at various census dates since 1890 (Table 32). In 1890, 1920, 1930, 1940, and 1950,

TABLE 32

Average Dwelling Unit or Structure Value, Rural Nonfarm and Urban, 1890-1950
(*dollars*)

		Average Value (Including Land)
1890	Rural nonfarm and cities under 8,000	2,244
	Cities over 8,000	4,373
1920	Rural nonfarm and cities under 25,000	3,905
	Cities over 25,000	5,805
1930	Rural nonfarm	2,661[a]
	Urban	5,743[a]
1940	Rural nonfarm	2,408
	Urban	4,131
1950	Rural nonfarm	7,200
	Urban	12,200

[a] Median value.

Note: For 1940-1950, values are for nonfarm, owner-occupied, mortgaged *dwelling units*. For 1890-1930, values are for nonfarm, owner-occupied, mortgaged *structures*.

Year — Source

1890 *Eleventh Census of the United States*, Bureau of the Census, Part III, "Report on Farms and Houses," p. 79.

1920 *Fourteenth Census of the United States*, "Mortgages on Homes in the United States," Census Monograph II, p. 102.

1930 *Census of Housing 1940*, Bureau of the Census, Vol. II, Part I, p. 49 (see Appendix D for discussion of the problem involved in determining whether 1930 data relate to structure or dwelling unit values).

1940 *Census of Housing 1940*, Vol. II, Part I, p. 45.

1950 *Census of Housing 1950*, Preliminary Reports, Series HC-5, p. 18.

existing rural nonfarm units or structures were uniformly of lower value than urban units or structures.[5] Thus the increasing proportion of dwelling units built in urban areas during the first four decades after 1890 probably tended to increase average expenditure per nonfarm dwelling unit, while the declining proportion during the following two decades tended to decrease it.

The shifts in the ratios of dwelling units built in one- and two-family

[5] It is difficult to interpret accurately the variations in the data as listed by the different censuses. The values listed include land. Further, at three dates the data refer to structure rather than dwelling unit values; at two dates, to mortgaged structures only; and at one date, to median rather than average values.

houses and multi-family structures have operated in a reverse manner. One-family houses are usually associated with a larger construction expenditure per unit than units in two- or more-family structures (Table 33). The decreasing proportion of one-family houses built in

TABLE 33

Average Permit Value per Dwelling Unit for New Private One-Family and Two-Family Houses and Multi-Family Structures, 257 Cities, All Urban, and All Nonfarm, Various Dates, 1922-1950

(*dollars*)

	One-Family Houses	*Two-Family Houses*	*Multi-Family Structures*
	257 Cities		
1922	4,259	3,568	3,950
1925	4,593	4,422	4,271
1930	4,994	3,924	3,857
1935	4,228	2,953	3,245
1940	3,890	2,760	3,075
	All Nonfarm		
1940	3,519	2,357	2,811
1945	3,740	3,379	3,415
	All Urban		
1950	7,770	5,570	6,155

Source: For 257 cities and all nonfarm, *Housing Statistics Handbook*, Housing and Home Finance Agency, 1948, pp. 15 and 16. For all urban, *Construction*, Bureau of Labor Statistics, February 1952, p. 21.

the 1890-1930 period, therefore, tended to lower the average expenditure per nonfarm dwelling unit, while the increase after the early thirties probably tended to raise it.

It is possible to make some rough calculations of the quantitative effect of these compositional changes and thus to assess their relative importance in the historical decline of real expenditure per unit. The data are insufficient to permit analysis of the period before the twenties, and even for the succeeding three decades the inadequacies of the data make it necessary to accept the results solely in terms of orders of magnitude.[6]

[6] Data are available on the distribution of new nonfarm dwelling units by urban and rural location since 1890 (Table 28), by type of structure since 1900 (Table B-2), and by regional location only since 1920 (Tables 26 and H-1). There are no data for any period on average construction expenditure (or permit valuation) for new urban and rural nonfarm units; therefore, the values of existing urban and rural nonfarm dwelling units were used (Table 32), adjusted to take account of different land ratios for urban and rural units. For average expenditure per unit by type of structure, data for the twenties are available only for 257 cities (*Housing Statistics Handbook*, Housing and Home Finance Agency, 1948, p. 15); for recent

The calculations involve the use of the standardization technique presented in another connection in Chapter V. It appears that the change in the regional distribution of new residential construction between the 1920-1929 decade and 1946-1950, acting in isolation, would have resulted in about a 6 per cent decline in construction expenditure per dwelling unit. The increase in the proportion of rural nonfarm units, a more important compositional change, would have resulted in about a 16 per cent decline in average expenditure, if other things had remained constant. On the other hand, the shift toward single-family dwellings since the twenties would have resulted in about a 5 per cent increase in per-unit expenditure.

These quantitative estimates of the effects of the separate changes in the composition of residential construction cannot simply be summed, since the compositional changes overlap considerably. Thus the urban-rural nonfarm shifts are closely related to changes in type of structure, and the regional shifts are related to both of these. But a rough approximation of the combined effects of changing composition on expenditure per dwelling unit would indicate that compositional changes alone would have led to about a 10 to 15 per cent decline in unit expenditure between the twenties and late forties. Since the total decline in unit expenditure over this period was 31 per cent ($5,321 to $3,663), composition changes apparently have accounted for about one-third to one-half of this fall in real expenditure per dwelling unit.

The remaining one-half to two-thirds of the decline must be accounted for by historical changes in those physical characteristics of dwelling units which would have reduced the average real value of new units even if no locational shifts or changes in structure type had occurred. However, the interrelations between geographical shifts and changes in structure types, on the one hand, and modifications in physical characteristics of dwelling units, on the other, are so complicated that it is difficult to isolate the latter completely.

Changes in the Physical Characteristics of the Dwelling Unit

Because the exterior materials of houses have not changed greatly over the past sixty or seventy years, because innovations in the interior have been piecemeal and gradual rather than revolutionary, and because modern equipment and improvements have been installed in

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years, data are available only for urban residential building (*Construction*, Bureau of Labor Statistics, February issue of each year). For variations in average expenditure by regions for the twenties, existing data cover only one-family houses in 257 cities (Wickens, *op. cit.*, p. 298). For recent years the data cover all urban residential construction (Table 31).

older houses,[7] the dwelling of today may seem not much different from the dwelling of 1890. Actually, however, there have been substantial changes in the physical characteristics of new dwelling units and they have significantly affected capital expenditures for housing. It is unfortunate that data in this area are so scanty that the changes cannot be measured with any degree of precision, but it is possible at least to identify the major innovations and to indicate their general order of importance. The changes that have taken place in the physical structure of new dwelling units may be grouped into three categories: changes in equipment and facilities, changes in size and layout, and changes in materials and the quality of construction.

Equipment and Facilities

Although the literature on changes in equipment and facilities in residential structures fails to give a systematic or comprehensive history, it is possible to present an informal account of the principal innovations that have occurred over the last half century or more.[8] Many of these have tended to raise real capital input per dwelling unit.

The typical urban dwelling of 1890 had at best a supply of cold running water. However, there were still many houses which had no running water or plumbing whatever, and for which water was carried from an outside source. Running hot water furnished by coke-fired heaters came into more general use at about this time and made possible a rapid extension of the hot water supply throughout the dwelling. According to one report, five out of six dwellers in American cities during the eighties had no facilities for bathing other than those provided by pail and sponge. The water closet had been introduced much earlier, but individual toilets in dwelling units were not common before the early years of the twentieth century. The bathroom as an integral part of the dwelling unit was of course dependent on hot water supply, and its adoption was stimulated by the manufacture of porcelain tubs, which are largely products of the twentieth century. Toilets and bathrooms added to capital input by requiring additional space, complicated plumbing facilities, floor and wall tilings, and medicine cabinets. Only dwelling units of the luxury type had more than one bathroom before the twenties. The provision of two or more

[7] These installations long after the date of construction make it impossible to use census data for 1940 and 1950 on age of structure and quality characteristics for tracing quality characteristics of new structures over time.

[8] The discussion of changes in equipment and facilities is based on the following sources, except where noted otherwise: Albert F. Bemis and John Burchard, 2nd, *The Evolving House*, Massachusetts Institute of Technology Press, 1933, Vol. I; Sigfried Giedion, *Mechanization Takes Command*, Oxford, 1948; and *U.S. Architecture, 1900-1950*, January 1950 issue of *Progressive Architecture*.

bathrooms in houses of more modest size, such as six to eight rooms, was a later development.[9]

Many of the individual houses built before the twentieth century, particularly those in less densely populated communities, had no basement and no foundation except posts. In other cases partially excavated basements, usually not floored, were used primarily for food storage. The construction of full basements became more common with the development of central heating and tended to include a sink for laundering and cement or other flooring as well as waterproofed walls. More recently, however, the construction of basements has been on the decline as more compact heating units that can be placed in small utility rooms have come into use.[10]

The typical urban dwelling of 1890, whether a single-family house or an apartment building, had no central heating plant. Fireplaces or individual space heaters such as cast iron stoves were in common use. The central solid-fuel furnace was coming to the fore, however, and was followed by gas- and oil-fired burners, which were introduced around 1916 for dwelling use, and by automatic stokers for solid fuel. The furnace, pipes, and radiators incorporated in residential structures represented substantial additions to capital investment in housing. Subsequent improvements in heating, down to the radiant heat and the combined heating and cooling systems of today, for the most part represent additional input of resources into residential structures.

Only a few urban dwellings of 1890 were wired for electricity, although the use of electric illumination made rapid progress. In fact, nonfarm dwellings at that time were often lighted by kerosene lamps provided by the occupants. According to one estimate, probably less than 5 million dwelling units were wired for electricity in 1906,[11] which was perhaps equal to 35 to 40 per cent of all units standing at that time. This number increased to 9 to 11 million units, or to probably 50 per cent of all units, during the early twenties. However, these data refer to both existing and new construction. It appears that the wiring of new urban dwellings had become standard practice at least shortly before World War I. This innovation represented in part substitution for gas pipes and installations so far as capital input is concerned. More important perhaps are the rapidly increasing number of con-

[9] Between 10 and 20 per cent of all single-family houses started in eight metropolitan areas in the second and third quarters of 1950 had more than one bathroom, according to *Regional Differences in Characteristics of New Houses*, Bureau of Labor Statistics Serial No. R 2075, 1952, p. 3.

[10] The frequency of basements varies with climatic conditions and differs from region to region.

[11] Letter to the authors from Frances Armin of the National Adequate Wiring Bureau, New York, January 16, 1951.

venience outlets provided and the rise in service capacities that are required to accommodate the growing use of portable lamps and particularly household appliances. As a result, the number of electric circuits for a given amount of floor area has increased rapidly.[12]

The provision of clothes and linen closets has increased greatly since 1890 and has added to capital input because of the doors and inside walls required, even if the closets have not expanded the size of dwelling units. Closets have replaced individual pieces of furniture previously bought by the users of housing units. Built-in furniture, such as china closets and bookcases, are in the same category.

Insulation materials of various types were developed during the twenties, but they did not come into general use in new residential construction before the thirties. The same is true for the now highly developed streamlined kitchen, with built-in cabinets integrated with stove and sink, replacing cupboards and other individual pieces of kitchen furniture often previously provided by the user rather than the builder of dwellings. Floor coverings for kitchen and pantries, such as linoleum (developed around 1900) and asphalt tile (first manufactured commercially in the early twenties), have also added to the capital cost of the house.

Finally, the garage must be listed as an important addition to capital input, not only in the single-family house field but also in multi-family construction (where garages are included in estimated construction expenditures if they form an integral part of the residential structure). The inclusion of garages in new residential buildings (or detached on the same lot) did not develop before the twenties except in isolated cases. It is now fairly common in single-family houses although by no

[12] Before 1928 the National Electrical Code required that no more than twelve outlets could be connected to a single circuit, but it did not specify a minimum number of circuits. The 1928 edition of the Code introduced the question of appliance loads as a factor in estimating service requirements. In this edition it was specified that service capacities be figured on the basis of 1 watt per square foot, plus 1,000 watts for total anticipated appliance loads. (Today there are often several appliances in use, each having a rating of 1,000 watts or more.) The 1928 edition required also that there be at least one circuit for every 1,200 square feet of floor area. In the 1935 edition of the Code the requirement that no more than twelve outlets be connected to a single circuit was waived *only* if there was one circuit for every *500 square feet* (instead of one circuit for every 1,200, as previously). In 1937 the Code for the first time required that the number of branch circuits be figured on the basis of probable loads and that the following loads be used as the basis for figuring circuit requirements: 2 watts per square foot for lighting, 1,500 watts for appliances. This edition also required at least one convenience outlet for every 20 feet, instead of every 30 feet, as previously recommended. In 1940, because of the trend toward simultaneous use of several appliances, the Code made mandatory at least one circuit of at least No. 12 wire, to serve convenience outlets *only* (not lights) in kitchen, laundry, and dining areas. From the letter quoted in the preceding footnote.

means universal. From 1937 to 1940, approximately 75 to 80 per cent of the new homes financed with FHA-insured loans under Section 203 of the National Housing Act had garages, but this proportion declined to 50 to 60 per cent in the first four years after World War II,[13] probably because garages were eliminated to reduce total costs and sales prices. On the other hand, the number of two- and three-car garages has increased substantially since the thirties.

The cost of a one-car garage usually accounts for about 5 to 8 per cent of the construction costs of a medium-priced single-family house. In addition, the inclusion of garages has often led to the installation of hard-surfaced alleys or other driveways. While the garage to some small extent represents a substitution for the stable, common in upper class residences in the more outlying areas before the automobile age, it has in most cases involved additional construction expenditures.

While the combined effect of these innovations since about 1890 defies measurement, it is sometimes alleged that the mechanical core of a modern single-family house accounts for about 40 per cent of the total building costs (exclusive of land).[14] This is probably an overstatement so far as additional capital input is concerned, for items of substitution are included in this type of reckoning.

Another approximation is provided by an itemized cost statement for a "composite" of typical (single-family) houses selected in various parts of the country.[15] According to this statement, the materials for plumbing, heating, finish hardware, electrical supplies, and insulation—most of which are items generally adopted since 1890—account for about 19 per cent of the total price of the materials delivered at the site. If labor cost and builders' overhead and profits on construction are distributed proportionately to materials cost, these items account for about 17 per cent of total costs to the purchaser, inclusive of land. However, the composite house underlying these calculations does not include a garage. The cost of heating equipment in houses which have such equipment is understated (as pointed out in the source) since houses in various regions, including those where no heating plant whatever is necessary, were "averaged" to arrive at composite cost estimates. Items such as closets and other built-in furniture or window screens are not specified in the cost statement. Inclusive of the omitted items, the ratio to total building costs may be closer to 25 per cent where heating equipment is furnished.

[13] *Annual Reports* of the Federal Housing Administration.

[14] Cf. Giedion, *op. cit.*, p. 625. The mechanized core includes kitchen, bath, heating, wiring, plumbing, and laundry equipment.

[15] *Housing Costs*, National Housing Agency (now Housing and Home Finance Agency), National Housing Bulletin 2, 1944. The data refer to 1935-1940.

An independent estimate prepared for this study yields similar results. According to this estimate, construction features and equipment items present in the bulk of single-family houses built today but absent in the bulk of such houses around the turn of the century account for roughly 25 per cent of present construction costs exclusive of land. About two-thirds of the additional cost applies to mechanical installations, and one-third to the structure.[16]

Here again, it must be kept in mind that this proportion measures the share of the specified parts and equipment in present costs rather than additional construction expenditures resulting from the grafting of these items on the house of 1890. That is, expenditures on new equipment and facilities probably have in part been substituted for expenditures on the central core of the house, and the *net* addition to real expenditures per dwelling unit resulting from such innovations has undoubtedly been less than 25 per cent.

But the addition of equipment and facilities has had a further effect. The increasing inclusion over time of services other than direct shelter in the gross rent (paid or imputed) for dwelling units has been a primary factor in determining the long-term movement of the capital-product ratio in residential real estate, here defined as the ratio of the value of such real estate to the gross rent produced by it. These services are in part associated with equipment and facilities, e.g. central heating and electric wiring, added to the dwelling unit in the last sixty years. (For a discussion of the role of these additions in changes in the capital-product ratio for residential real estate, see Appendix I.)

In general, the increase in rents associated with the addition of equipment and facilities has been more than proportionate to the increase in real capital involved in such additions. To the extent that consumers are limited in the kind of housing accommodations they will occupy by the current outlays for such accommodations, the increase over time in rents per unit of capital outlay has probably further tended to restrict the increase in quantity of real capital per dwelling unit associated with the addition of such equipment. That is, the competition within the rent bill between new equipment and facilities, whose ratio of current rent to capital cost is relatively high, and the

[16] This estimate was prepared by Leo F. Murphy of New York City, a construction cost estimator with several decades of experience, and John Rannells, an architect on the staff of the Institute for Urban Land Use and Housing Studies, and is based on itemized cost statements for a two-story house with approximately 900 square feet on each floor and a two-thirds basement. The following construction feature and equipment items, additional to the 1890 costs, are included: basement slabs, roof insulation, increase in number of closets and built-in cabinets, additional heating facilities, additional gas or electrical facilities, and additional plumbing and tile work.

basic core of the dwelling unit, whose ratio of current rent to capital is lower, probably has resulted in greater reduction of expenditures on the dwelling core than would have been the case had the ratio of rent to capital outlay been the same for both segments of the dwelling unit. An estimate of the share of such equipment and facilities in the total capital cost of a typical home today, therefore, overstates, on this score as well, the net effect of the addition of equipment and facilities on the input of real capital per dwelling unit.

Size of Dwelling Unit

It is difficult to determine with any great certainty whether the average dwelling unit of today is smaller than the average dwelling unit of 1890. Few statistical data are available to clarify or illuminate this point, except information on room counts. But room counts are inadequate descriptions of changes in the size of dwelling units. The square foot area and cubage are at least as important, but no data for any length of time are available for application of this measurement.

A look at old mansions in American cities and houses in older suburban areas compared with newer suburbs suggests that the average size of the dwelling has declined in recent decades. In upper and middle class housing the parlor, sewing room, and servants' quarters (usually in attics or basements) have indeed disappeared as household functions have been transferred from the home to commercial establishments and as mechanized equipment has replaced labor. However, individual homes and tenement houses built for workers and the lower middle class before the turn of the century were quite small, as is evident from inspection of pictures, floor plans,[17] and old structures still standing—possibly smaller than those now built in lower price ranges. But observation provides only limited guides to changes in size of dwelling units.

The only available data on the floor area of new houses relate to 1940 and 1950. They indicate a substantial decline in the size of new single-family detached houses. The average floor area in 1940 for a large sample of FHA-insured new single-family houses was 1,177 square feet. A sample of new single-family houses started in the first half of 1950 indicated an average floor area of 983 square feet.[18]

Data are available with regard to changes in the number of rooms per dwelling unit over a longer period of time. This measure also indicates a decline in dwelling unit size. A special tabulation for this study of preliminary sample data from the 1950 Census of Housing (Table

[17] Cf. James Ford *et al., Slums and Housing,* Harvard University Press, Vol. I, 1936.

[18] *The Materials Use Survey,* 1952, p. 5.

34) shows the median number of rooms per dwelling unit for units built at varying times. The data indicate a steady decline in the median number of rooms per dwelling unit from the twenties to the post-World War II period. In the case of buildings standing in 1950, the median number of rooms for nonfarm dwelling units built before 1920 was slightly lower than for those built during 1920-1929 but higher than for all units built since 1930.

TABLE 34
Median Number of Rooms per Dwelling Unit by Year Built, Urban and Rural Nonfarm Dwelling Units, April 1950

YEAR BUILT	MEDIAN NUMBER OF ROOMS		
	Urban and Rural Nonfarm	*Urban*	*Rural Nonfarm*
1945 or later	4.26	4.35	4.16
1940-1944	4.39	4.43	4.30
1930-1939	4.56	4.80	4.12
1920-1929	4.81	4.87	4.47
1919 or earlier	4.76	4.63	5.29

Source: Table J-2.

Allowance for a bias inherent in the series of median room counts increases the likelihood of a historical decline in dwelling unit size. The data all refer to the size of dwelling units of various ages in April 1950, rather than to the size at the time of construction. A considerable number of conversions within the structures standing in 1950 had taken place over the years. Such conversions usually increased the number of dwelling units within a given structure and thus generally decreased the number of rooms per dwelling unit. Since conversions usually take place in older structures, a count in a current year of the number of rooms in dwelling units of various ages tends to underestimate the number of rooms in older dwelling units at the time of construction, and to underestimate increasingly this number as one shifts one's view to older and older units. In Table 34 this underestimate is probably particularly significant for the class of dwelling units built before 1920, units which were at least 30 years old in 1950. The true median number of rooms per unit for this class at the time of construction was undoubtedly much higher than that indicated by the 1950 count and probably higher than for dwelling units built in any succeeding period.

Only for recent periods is direct information available on newly constructed units. According to the *Annual Reports* of the Federal Housing Administration, the median number of rooms in new single-family houses financed with FHA loans under Section 203 of the

National Housing Act was 6.2 in 1936, 5.7 in 1938 and 1939, 5.5 in 1941 and 1942, and 4.9 in 1949 and 1950. The median rose, however, to 5.2 in 1951 and 5.3 in 1952. Observation would seem to indicate that similar declines occurred in non-FHA-financed houses. The median number of rooms in new rental housing projects financed with FHA-insured loans has shown no pronounced trend, starting at 3.9 during the period 1935-1941, rising slightly to 4.0 in 1942-1946 and again to 4.7 in 1947 and 1948, declining to 4.0 in 1949, and rising to 4.2 in 1950, 4.6 in 1951, and 4.8 in 1952.

The decline in the number of rooms per dwelling unit is, of course, closely associated with the drop in the average size of the household (see Chapter V). If the decline in the number of rooms per dwelling unit between the twenties and late forties is used as an index of the decline in the size of the dwelling unit, then average dwelling unit size decreased by at least a seventh between these two periods. This decrease was probably more than enough to compensate for the addition of new equipment and facilities since the twenties.

Changes in Materials and Design

It is even more difficult to judge the effects of changes in materials and design on construction expenditures. A first impression may be that new residential structures are less durable than old ones, but materials and structure design differ so much that the impression may be misleading.

It is probably true, however, that there has been considerable lightening of the frame of the typical single-family house, as well as a greatly increased use of exterior nonbearing curtain walls of composite materials (with skeleton frame structural supports) in multi-family construction in lieu of the multi-layer wall formerly predominant. Similarly, gypsum and other wallboards have come into widespread use in residential construction over the last three decades, as have gypsum lath and insulating lath as a base for plaster. And asphalt shingle or similar roofing materials have in significant measure replaced the slates more frequently used in earlier decades. The substitution of lighter for heavier materials does not necessarily reduce durability although it has tended to reduce construction expenditures by significant amounts.[19]

Analysis of F. W. Dodge Corp. data on trends in the dollar volume and floor area of residential construction, as indicated by contracts

[19] The importance of changes in structural materials and design is indicated by the fact that the structural shell of a typical prewar single-family house accounted for about two-thirds of the total costs of the house, exclusive of land and land improvements (see *Housing Costs*, p. 21).

awarded in thirty-seven eastern states, corroborate the conclusion that changes in materials and design have substantially reduced real expenditure per dwelling unit. The contract cost of residential construction per square foot, adjusted for price changes, rose slightly from 1920-1924 to 1925-1929 and then declined steadily to the war years, with only a slight recovery in the postwar period. In 1950-1953 the real average contract cost per square foot of residential construction was about 14 per cent below the level in 1920-1924, about 26 per cent below the level in 1925-1929, and only 8 per cent above the low point in 1940-1944. These data eliminate the effect of declining dwelling unit size but still typically include expenditures on equipment and facilities. A series on real construction expenditure per square foot, exclusive of equipment and facilities, would undoubtedly show an even sharper decline, because of the substantial increase since the twenties in equipment and facilities provided in new houses. The decline in price-adjusted contract cost per square foot offers additional evidence, even though the Dodge data from which the cost figures are calculated are not primarily designed for this purpose, that a major part of the fall in real expenditure per dwelling unit over the last three and a half decades has resulted from changes in structural materials and design.[20]

Summary

The average construction expenditure per dwelling unit in current prices has more than quadrupled over the last six decades. However, the construction expenditure per unit in constant prices has declined by about two-fifths over this period. This fall was fairly continuous over the entire period except for a sharp increase in real expenditure during the twenties.

The decline in real expenditure per unit has been the net result of many forces, some of which have tended to increase this expenditure while others, apparently of greater importance, have tended to decrease it. The analysis of the factors affecting average real expenditure is highly complex because of the degree of interconnection among the various factors.

[20] Five-year averages of the annual contract cost (in 1929 prices) per square foot of residential construction are:

1920-1924	$4.45
1925-1929	5.18
1930-1934	4.76
1935-1939	4.23
1940-1944	3.58
1945-1949	3.73
1950-1953	3.86

These averages were derived from contract award data published by the F. W. Dodge Corp.

The compositional and physical changes tending to increase real capital per dwelling unit include the gradual addition of equipment and facilities and, since the twenties, the increasing proportion of new dwelling units accounted for by single-family houses. The changes tending to reduce real capital per unit include shifts in the regional distribution of new dwelling units toward regions characterized by lower construction expenditure per unit, the decline in the average size of new dwelling units, the substitution of lighter materials and of a lightened structural frame, and the rise in the proportion of dwelling units built in rural nonfarm areas since the twenties.